

## What is Claimed:

- 1                   1.     A bonding tool for bonding a wire to a substrate, the bonding tool  
2     having a body and a working tip coupled to one end of the body, and comprising:  
3                   an orifice extending along a longitudinal axis of the body and the working  
4     tip; and  
5                   a coating disposed over at least a portion of a surface of the orifice.
- 1                   2.     A capillary bonding tool according to claim 1, wherein the coating  
2     extends along an entire length of the orifice.
- 1                   3.     A capillary bonding tool according to claim 2, wherein the coating  
2     is applied to at least a portion of an exterior surface of the working tip.
- 1                   4.     A capillary bonding tool according to claim 1, wherein the coating  
2     is disposed over at least a portion of an exterior surface of the working tip.
- 1                   5.     A capillary bonding tool according to claim 1, wherein the coating  
2     is disposed over an exterior surface of the working tip and the body.
- 1                   6.     A capillary bonding tool according to claim 1, wherein the coating  
2     is a polymer.
- 1                   7.     A capillary bonding tool according to claim 1, wherein the coating  
2     is at least one of i) a polymer, ii) an Alumina, iii)  $\text{Si}_3\text{N}_4$  iv) silica v) a combination of  
3     12% silica and 88% Alumina, and vi) Diamond like Silica (DLC).
- 1                   8.     A capillary bonding tool according to claim 1, wherein the coating  
2     is a polymer disposed along an interior surface of the orifice and one of i) an Alumina,  
3     ii)  $\text{Si}_3\text{N}_4$ , iii) silica, iv) a combination of 12% silica and 88% Alumina, and v) Diamond  
4     like Silica (DLC) disposed along an exterior portion of the orifice.
- 1                   9.     A capillary bonding tool according to claim 1, wherein the coating  
2     has a substantially uniform thickness.
- 1                   10.    A capillary bonding tool according to claim 1, wherein the coating  
2     has a substantially uniform thickness of up to about 2.0 microns.
- 1                   11.    A capillary bonding tool according to claim 1, wherein the coating  
2     has a substantially uniform thickness of about 0.1 microns.

1                   12.    A capillary bonding tool according to claim 1, wherein the body of  
2 the bonding tool has a substantially cylindrical shape.

1                   13.    A capillary bonding tool according to claim 1, wherein the coating  
2 is one of polyolefine and parylene.

1                   14.    A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by vapor phase deposition.

1                   15.    A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by one of chemical vapor deposition and physical vapor deposition.

1                   16.    A capillary bonding tool according to claim 1, wherein the coating  
2 is formed by immersing the bonding tool in a coating material.

1                   17.    A method of manufacturing a capillary bonding tool for bonding a  
2 fine wire to a substrate, the method comprising the steps of:

3                   forming a cylindrical body;

4                   forming a taper at a first end of the body;

5                   forming an orifice extending along a longitudinal axis of the body; and

6                   coating at least a portion of the orifice with a polymer.

1                   18.    The method according to claim 17, wherein the coating step forms  
2 a substantially uniform continuous coating having a thickness of up to about 2.0  
3 microns.

1                   19.    The method according to claim 17, wherein the coating step forms  
2 a substantially uniform continuous coating having a thickness of at least about 0.1  
3 micron.

1                   20.    The method according to claim 17, wherein the coating step  
2 comprises the steps of:

3                   forming a precursor monomer at a first temperature and a first pressure;

4 and

5                   forming the coating from the precursor monomer at a second temperature  
6 and pressure.

1                   21.    The method according to claim 20, wherein

2 the first temperature is about 690°C,  
3 the first pressure is about 0.5 torr,  
4 the second temperature is about 25°C, and  
5 the second pressure is about 0.1 torr.

1 22. The method according to claim 20, wherein the precursor monomer  
2 is formed from a di-Para-Xylyene dimer vaporized at about 150°C and about 1.0 torr  
3 followed by a pyrolysis at about 690°C and about 0.5 torr.

1 23. The method according to claim 17, wherein the capillary is formed  
2 by i) one of direct ceramic dye pressing and ii) injection molding, and machined to a  
3 final shape by one of i) grinding and ii) Electro discharge machining.

1 24. A bonding tool for bonding a wire to a substrate, comprising:  
2 a body portion;  
3 a working tip coupled to one end of the body;  
4 an orifice extending along a longitudinal axis of the body and the working  
5 tip;  
6 a first coating disposed over at least a portion of a surface of the orifice;  
7 and  
8 a second coating disposed over at least a portion of an exterior surface of  
9 the body.

1 25. A capillary bonding tool according to claim 24, wherein the first  
2 coating is a polymer and the second coating is other than a polymer.

1 26. A capillary bonding tool according to claim 25, wherein the second  
2 coating is one of an alumina and  $\text{Si}_3\text{N}_4$ .

1 27. A method of manufacturing a capillary bonding tool for bonding a  
2 fine wire to a substrate, the method comprising the steps of:  
3 forming an orifice extending along a longitudinal axis of the bonding tool;  
4 coating at least a portion of the orifice with a polymer; and

- 5 coating at least a portion of an exterior surface of the bonding tool with a
- 6 non-polymer coating.